

AR39

**1965 Annual Report**  
**HARBISON-WALKER REFRACTORIES COMPANY** 

## **DIRECTORS**

F. H. Atwood  
A. B. Bowden  
C. A. Brashares  
James W. Craig  
Richard G. Croft  
Ralph S. Euler  
E. T. Hile  
Robert L. Kirkpatrick  
P. C. Mitchell  
J. C. Willey  
A. Brent Wilson

## **OFFICERS**

A. Brent Wilson  
*President*  
E. T. Hile  
*Vice President*  
P. C. Mitchell  
*Vice President*  
C. A. Brashares  
*Vice President*  
Lawrence E. Mock  
*Vice President and Treasurer*  
Thomas Welfer  
*Secretary*



A. Brent Wilson

## PRESIDENT'S LETTER TO THE SHAREHOLDERS:

**INTRODUCTION** Numerous records were set by Harbison-Walker Refractories Company and subsidiaries during the first year of its second century of business. Sales of products and services were over 9.1% greater than the record set in 1964. Record earnings in 1965 were up 13.6% over 1964. As shareholders, your assets and equity in the Company were increased again to highest levels.

**SALES** The total \$124,693,649 products and services sold during 1965 were the highest in the 101 years of the business. After 2 consecutive half-year records in 1964,

billings in the first half of 1965 reached all-time heights. Although demand for refractory products eased slightly, sales in the last half were the second highest in history. Technical services sold during the year continued to increase.

Gains were achieved in products sold for almost all operating applications. Sales were substantially increased to operators of glass-tank furnaces, chemical plants and processes, and copper reverberatory smelt-

Year	Products and services sold
1965	\$124,693,649
1964	114,343,691
1963	96,808,725
1962	84,079,322
1961	84,755,473

ing furnaces (highlighted on page 12).

Refractories shipped for new construction by customers set a record. Basic Oxygen Furnace steelmaking capacity was increased nationally by over 40% for the second consecutive year. Nine BOFs were added in 4 shops. All of the new BOFs used Harbison refractories. Demand for BOF operating refractories was also up in 1965. Sales of refractories to operators of electric steelmaking furnaces were also record highs.

Export sales were at all-time heights. Your Company's net inflow of all transactions with developed foreign countries exceeded 1964 by nearly 25%—some 50% above the guidelines requested by President Johnson.

**INCOME** The record \$13,407,171 net income for 1965 was earned by effective sales efforts, especially in new products. Bolstered by increased profits from consolidated subsidiaries

abroad, Company earnings were \$1,604,183 greater than in 1964. Net income was up 53¢ from last year's \$3.81 to \$4.34 per Common share outstanding at December 31, 1965.

Year	Net income	Per share
1965	\$13,407,171	\$4.34
1964	11,803,038	3.81
1963	7,784,174	2.49
1962	6,166,109	1.96
1961	7,053,268	2.25

**COST OF PRODUCTS AND SERVICES SOLD** Excluding depreciation and depletion charges, mining and manufacturing costs of products and services sold during 1965 were \$78,233,902.

This compares with \$71,074,985 in 1964. Depreciation and depletion charges of \$6,442,208 exceeded 1964 by \$483,546, as detailed in the table at right.

Year	Depreciation and depletion
1965	\$6,442,208
1964	5,958,662
1963	5,213,262
1962	5,226,323
1961	4,930,769

#### Employment

costs were up over 11.0% above 1964 and set a record for the third consecutive year. Pension costs were \$1,163,657 for 1965 services and \$208,947 for interest on the unfunded part of past services, actuarially estimated December 31 at \$5,770,000. The liability reflects an additional \$890,000 due to more precise computations by actuaries.

**INCOME TAXES** Tax depreciation exceeded normal depreciation. The excess reduced current taxes. The reduction was deferred to future income. The 1965 investment credit reduced current expense. Tax returns for years 1961 through 1963 are now being examined by the District Director of Internal Revenue. Taxes provided through 1965 are considered adequate.

**DIVIDENDS** Harbison shareholders received \$5,795,572 in cash dividends paid in 1965. Preferred shareholders were paid a total of \$180,000 at \$1.50 per share on the 20th of January, April, July and October. A total of \$5,615,572 was paid to Common shareholders at the continued rate of \$1.80 per share distributed 45¢ on the first of March, June, September and December.

The Board of Directors declared January 27, 1966 the regular quarterly dividend of \$1.50 per Preferred share payable April 20 to shareholders of record April 6. A 45¢ cash dividend per Common share payable March 1 to shareholders of record February 10 was also declared by the Board.

**FINANCIAL POSITION** Net working funds of \$51,523,894 at December 31, 1965 approximated funds at year-end 1964. Your Company's current assets were 4.0 times current liabilities. More cash will be needed for federal income taxes as payments are accelerated in 1966. Even more acceleration is being sought by President Johnson.

Common shares were purchased for the Treasury in the open market at an average of \$38.74 per share. It is the present intent of your Company's management to use the shares for general corporate business. Total shareholders' equity at year end of \$113,786,874 set a new record. Equity per share exceeded 1964 by \$1.24 and represented \$32.80 per Common share outstanding December 31, 1965.

**FIXED ASSETS ADDED** The \$13,985,624 invested during 1965 for additions and normal replacements of fixed assets was the highest since 1951. To satisfy increased demand for

highest purity and density, additional processing facilities were substantially completed at the Ludington, Michigan basic materials plant. Together

with the completion of new calcining furnaces and manufacturing equipment, the facilities represent the largest expenditure during 1965.

To strengthen your Company's position as the leading supplier of Basic Oxygen Furnace refractories, additional storage facilities were completed and the fabricating capacity was substantially increased at the Hammond, Indiana basic refractories plant. The fabricating capacity enables your Company to become, for the first time, a major supplier of high purity dolomite refractories. As more BOF operators are zoning furnace linings, a complete line of BOF refractories is a distinct sales advantage.

A second tunnel kiln at the Baltimore, Maryland plant was modified for higher temperatures. The kiln will expand production of high-fired basic brick, proven superior for electric furnaces and open hearths. The rotary kiln to calcine clay for refractories specialties was completed at Fulton, Missouri. A kiln was modified, additional power presses installed and storage added at the Windham, Ohio basic fabricating plant. The Windham plant is the major supplier of BOF refractories.

Near completion at the Marelac, Quebec basic refractory fabricating plant are a tunnel kiln and dryer. This third kiln at the plant is designed for high temperatures.

Year	Equity per share
1965	\$32.80
1964	31.56
1963	29.59
1962	28.36
1961	28.21

Year	Fixed assets added
1965	\$13,985,624
1964	7,170,106
1963	5,795,085
1962	5,315,511
1961	3,515,430

The newly completed kiln at Abbotsford, British Columbia will enable production of refractories and facebrick to satisfy the growing northwest demand. At the Cape May, New Jersey seawater magnesite plant, a large storage tank was completed and the third magnesite kiln was altered.

The warehouse expansion program for providing customers with fast delivery continued in 1965. Following the 1964 expansion at Pittsburgh and Los Angeles, the present Cleveland warehouse was enlarged. New and larger warehouse facilities were acquired at Buffalo. Plans are now final for a new warehouse at Houston.

Construction began recently on a major addition to the Research Center near Pittsburgh. The addition, largely in pilot plant facilities and scheduled for completion this year, will mark the second major expansion in the Center since its dedication. Always regarded as the world's largest, most complete and advanced refractories research facility, the new expansion illustrates significantly the great importance your Company places upon pioneering research in refractories.

**PRODUCT RESEARCH AND DEVELOPMENT** The Company's new products continue dramatically to modify its business. Over 25% of 1965 products sold were introduced since the June 4, 1959 dedication of the Research Center. The success of the new products is a tribute not only to Harbison's research scientists but also to production employees and salesmen.

Last year one of your Company's new products OXILINE B earned an Industrial Research award as one of the 100 most significant new technical products of 1964. Harbison again earned the award for 1965 with NUCON, representing the first of the class of direct-bonded, basic refractories. NUCON proved its ability to increase lining life of electric furnaces and open-hearth steelmaking furnace roofs and walls.

The related research development of utilizing electrically-fused refractory grain has resulted in the production of basic refractories of unprecedented high density. The first commercial brand is GUIDON. It significantly extends the life of critical areas in open-hearth and electric furnaces, in steel degassers, in glass-tank furnaces, and in copper reverberatory smelting furnaces and converters.

Other new products also have gained rapid acceptance by the copper industry. To meet its more severe demands of full-capacity operation, H-W COPUR shapes and COPURBOND mortar were developed specifically for copper converters. The resistance to copper penetration by H-W HARMIX CU's new principle has enabled copper producers to extend greatly the life of induction furnace linings. For the glass industry, the new products TOPEX S and MAGNEX S were developed to extend the life of glass-tank regenerators, where refractories must resist severe attack by alkali fluxes.

Your Company's research programs are benefiting from the exchange of ideas with research scientists of other organizations. The cooperation is most fruitful when customers, working on new high-temperature processes, have used the unique facilities and talented staff of the Research Center. During 1965 cooperative studies involved several glass manufacturers, an important zinc producer, several steelmaking firms and a major automobile manufacturer. Harbison's research cooperation permitted a leading electrical company to expedite the production of the world's largest fused-silica article—a dimensionally stable 151-inch astronomical mirror.

To assure protection of your Company's new products, a patent staff, established a few years ago, was increased to administer the growing number of newly developed products. A total of 54 patents was issued in 1965, over twice the number in any prior year. Most of the developments are also protected by foreign patents.

Harbison is a major supplier of specialty granular refractory products. Growth of specialties sales in the past 5 years has been dynamic. New products again are major factors in the growth. KORUNDAL PLASTIC and several high-alumina plastics like CORALITE and H-W MULLITE have proved superior in foundry, electric furnace and non-ferrous applications. The life of ladles has been substantially lengthened with CORALBOND mortar. HARCHROME and HARCHROME G have gained wide acceptance as castables by petrochemical and other non-ferrous operators.

Quite apart from refractories, your Company has entered the structural clay products field with its HARBISON GIANT. The fired, large brick offers architects a unique and attractive design. It provides smooth, non-porous walls both inside and out. It is economical to builders as its cost installed is below conventional facebrick and concrete block construction. A Clearfield, Pennsylvania plant is devoted entirely to the production of HARBISON GIANT. Its acceptance is gaining, especially for institutional and commercial construction.

**EMPLOYEE RELATIONS** Your Company continued its satisfactory employee relationships during 1965. There were no work stoppages. Twenty-two domestic labor contracts with 5 international unions will expire in the third quarter of 1966, while 8 contracts with a sixth international are subject to reopening in the final quarter on wages and various fringe benefits.

Formal training programs for craft jobs were installed in several works. The programs will provide qualified employees with opportunities for increasing their skills.

A plan to provide cash awards to production and maintenance employees for suggestions to improve safety and reduce costs was started in 1964. Of 575 suggestions submitted from 24 locations during the past year, 169 were accepted for awards.

Lost-time accident frequency improved over 1964. Eight plants and all mining operations lost no time by accidents and qualified for National Safety Council recognition.

During the year 36 sons and daughters of employees received scholarship grants from Harbison-Walker Foundation, Inc. Including earlier active grants, 68 awardees received financial aid for college in 1965. Since the program was established modestly in 1953, 233 children of employees have been awarded this educational assistance. Your Company assisted 35 employees by reimbursing costs of studies successfully completed in job-related courses at approved colleges, trade and business schools.

Since its May 1, 1957 inception, a payroll savings plan for salaried employees to acquire equity purchased 87,740 Common shares in the open market. The plan will distribute to 647 participants during this month over 10,400 shares purchased in 1963. Nearly 80% of eligible employees participate in the plan.

**ANNUAL MEETING** The annual meeting of shareholders will be held at 10 a.m. April 28, 1966 in the principal office at 2 Gateway Center, Pittsburgh 15222. You should receive about March 24 a notice of the meeting and a proxy statement and form. If you cannot attend, please sign and return your proxy.

**OUTLOOK** Increasing orders indicate that the high level of operations by customers during 1965 has continued into the early months of 1966. Record demands apparently shortened slowdowns by customers during inventory liquidation. Forecasts of continued heavy spending by customers for greater productive capacity indicate that demand for refractories should continue strong in the next few months. The modernization that is inherent in heavy capital spending requires greater proportions of higher quality and performance refractories. Demand for such prescription-type refractories should be beneficial to your Company.

The large investment in fixed assets by Harbison during 1965 will provide capacity for much of the growing refractories demand. Expenditures in 1966 consequently are not expected to equal the 1965 level. Expenditures, largely for replacements, may approach \$10,000,000, however.

Your Company this month agreed to acquire Tanner Plating Company. At its New Castle, Pennsylvania plant, Tanner provides heavy industry with unique services of quality hard chrome plating. It plates massive steel rolls and other equipment up to 60 feet in length and up to 100 tons in weight. Growth has been impressive; its potential appears quite promising. For all outstanding Tanner capital shares, Harbison will exchange 9,314 Common treasury shares and not more than 11,621 additional shares later in 1966. The pooling of interests of Harbison and Tanner will enable Tanner to provide its quality hard chrome plating services to more customers.

Continued record performances by your Company for the third consecutive year largely rely on the uninterrupted high levels of production by Harbison's customers which compose the numerous basic industries. Even with high operating levels, the objective of record performances is challenged by 4 existing situations. Most contracts with domestic unions will be open for negotiation on economic issues in the second half of 1966. Social security taxes paid by the Company will be higher in 1966; at current rates, the 1965 payroll taxes would have been up over 40%. The higher employment costs of 1964 and 1965 have not been recoverable, as the few selective price increases in 1965 contributed only nominally to revenues. Due to large 1965 expenditures, depreciation and depletion charges will be up.

The records established by your Company in the past year—the 101st of its business—reflect the devoted efforts and effective work of Harbison's employees.

Yours truly,



President

2 Gateway Center  
Pittsburgh 15222  
February 2, 1966

## CONSOLIDATED CURRENT AND RETAINED INCOME

### REVENUES:

Year ended December 31,

	1965	1964
Products and services sold .....	\$124,693,649	\$114,343,691
Dividends, interest and other income .....	1,417,393	1,170,844
	<u>126,111,042</u>	<u>115,514,535</u>

### COSTS:

Employment (page 4):

Wages and salaries .....	36,010,120	32,282,229
Social security taxes .....	1,524,300	1,420,204
Pensions, insurance and other fringes .....	3,392,587	3,153,521
	<u>40,927,007</u>	<u>36,855,954</u>
Materials, supplies and services purchased (page 4) .....	49,903,524	45,638,304
Depreciation and depletion .....	6,442,208	5,958,662
Interest expensed .....	704,872	663,651
Minority shareholders' interest in subsidiaries' income .....	1,396,368	1,038,870
Taxes, other than payroll and income taxes .....	1,432,592	1,370,841
Federal, foreign and state income taxes provided (page 4) .....	11,897,300	12,185,215
	<u>112,703,871</u>	<u>103,711,497</u>
<b>NET INCOME FOR THE YEAR .....</b>	<b>13,407,171</b>	<b>11,803,038</b>

### DIVIDENDS DECLARED:

Preferred at \$6.00 per share .....	180,000	180,000
Common at \$1.80 per share .....	5,615,572	5,666,491
	<u>5,795,572</u>	<u>5,846,491</u>

### CONSOLIDATED INCOME RETAINED IN THE BUSINESS:

During the year .....	7,611,599	5,956,547
At beginning of year .....	61,949,082	55,992,535
At end of year (note 1) .....	<u>\$ 69,560,681</u>	<u>\$ 61,949,082</u>

*See accompanying notes*

**HARBISON-WALKER REFRactories COMPANY and subsidiaries**

# CONSOLIDATED

<b>NET ASSETS</b> ..... <i>at December 31,</i>	<b>1965</b>	<b>1964</b>
<b>WORKING FUNDS:</b>		
Current assets:		
Cash .....	\$ 6,989,416	\$ 6,835,053
Marketable securities at cost, quoted December 31, 1965 at \$7,192,804 .....	6,538,575	15,409,466
Accounts receivable .....	18,961,688	16,310,278
Inventories, at costs below market:		
Refractory brick finished and in process, at last-in, first-out cost .....	10,706,336	9,305,461
Other products, raw materials and supplies, at average cost .....	24,928,054	22,336,589
Prepaid expenses .....	431,120	526,550
Total current assets .....	<u>68,555,189</u>	<u>70,723,397</u>
Current liabilities:		
Federal, foreign and state income taxes (page 4) .....	6,460,291	8,795,307
Accounts payable and other liabilities .....	10,571,004	8,867,387
Total current liabilities .....	<u>17,031,295</u>	<u>17,662,694</u>
Net working funds .....	<u>51,523,894</u>	<u>53,060,703</u>
<b>INVESTMENTS</b> , at cost below underlying equity .....	<u>5,628,365</u>	<u>5,538,890</u>
<b>FIXED ASSETS:</b>		
Buildings, machinery and equipment, at cost .....	160,117,772	148,265,900
Less accumulated depreciation .....	97,581,004	92,914,117
Net buildings, machinery and equipment .....	<u>62,536,768</u>	<u>55,351,783</u>
Mineral deposits, at cost less depletion .....	7,041,640	7,217,444
Land, at cost .....	2,456,207	2,335,794
Net fixed assets .....	<u>72,034,615</u>	<u>64,905,021</u>
Total working funds, investments and fixed assets .....	<u>129,186,874</u>	<u>123,504,614</u>
<b>NOTES PAYABLE</b> \$400,000 semiannually from February 1, 1967 at 4% ..	(12,000,000)	(12,000,000)
<b>DEFERRED</b> federal income taxes (page 4) .....	<u>(3,400,000)</u>	<u>(2,394,000)</u>
Net assets, in which shareholders' equity is invested .....	<u>\$113,786,874</u>	<u>\$109,110,614</u>

See acc



## FINANCIAL POSITION

<b>SHAREHOLDERS' EQUITY</b> ..... at December 31,	<b>1965</b>	<b>1964</b>
<b>MINORITY SHAREHOLDERS' INTEREST</b> in subsidiaries .....	<u>\$ 10,744,385</u>	<u>\$ 9,836,742</u>
<b>COMPANY SHAREHOLDERS' EQUITY:</b>		
Preferred shares, 6% cumulative, non-callable, \$100 par value; authorized and issued—30,000 shares .....	<u>3,000,000</u>	3,000,000
Common shares, \$7.50 par value; authorized 4,000,000 shares; including shares in Treasury deducted below (note 2):		
Issued 3,150,445 .....	<u>23,628,338</u>	—
Issued 3,148,844 .....	—	<u>23,616,330</u>
Capital in excess of par value; the increase represents net excess of proceeds over par value of unissued shares and cost of treasury shares sold (note 2) .....	<u>10,743,463</u>	10,708,460
Income retained in the business (note 1) .....	<u>69,560,681</u>	<u>61,949,082</u>
	<u>103,932,482</u>	<u>96,273,872</u>
Less 100,416 common shares in Treasury, at cost .....	<u>3,889,993</u>	—
Common shareholders' equity .....	<u>100,042,489</u>	<u>96,273,872</u>
Total Harbison-Walker Refractories Company shareholders' equity	<u>103,042,489</u>	<u>99,273,872</u>
Total shareholders' equity .....	<u><u>\$113,786,874</u></u>	<u><u>\$109,110,614</u></u>

ing notes

**HARBISON-WALKER REFRactories COMPANY and subsidiaries**

## **CONSOLIDATED SOURCE AND USE OF FUNDS**

<b>SOURCE:</b>	<i>Year ended December 31,</i>	<b>1965</b>	<b>1964</b>
Operations:			
Net income for the year .....	\$13,407,171	\$11,803,038	
Non-cash costs charged against current income:			
Depreciation and depletion .....	6,442,208	5,958,662	
Federal income tax deferred .....	1,006,000	743,059	
	<u>20,855,379</u>	<u>18,504,759</u>	
Minority shareholders' interest in subsidiaries:			
Net income undistributed .....	934,258	538,750	
Capital shares sold (purchased) .....	(1,615)	1,293	
Common shares sold .....	115,899	74,973	
Net cost of fixed assets retired .....	413,822	217,466	
	<u>22,317,743</u>	<u>19,337,241</u>	
 <b>USE:</b>			
Fixed assets added and replaced .....	13,985,624	7,170,106	
Investments purchased .....	89,475	288,791	
Minority interest in debt liquidated by subsidiary .....	25,000	65,000	
Common shares purchased for the Treasury .....	3,958,881	—	
Cash dividends declared .....	5,795,572	5,846,491	
	<u>23,854,552</u>	<u>13,370,388</u>	
 <b>WORKING FUNDS:</b>			
Net increase (decrease) during the year .....	(1,536,809)	5,966,853	
At beginning of year .....	53,060,703	47,093,850	
At end of year .....	<u>\$51,523,894</u>	<u>\$53,060,703</u>	

*See accompanying notes*

## NOTES TO FINANCIAL STATEMENTS

### 1. Income retained in the business

Of \$69,560,681 consolidated income retained in the business at December 31, 1965, \$40,474,760 was restricted as to dividends by the note agreement.

### 2. Option plan

Officers and key employees exercised options on 3,385 common shares at \$28.19 or \$35.91 each; and at year end options on 34,709 shares were exercisable at \$28.19 to \$47.85 each. Options on 109,995 shares may be granted until April 26, 1966.

## ACCOUNTANTS' REPORT

### ARTHUR YOUNG & COMPANY CERTIFIED PUBLIC ACCOUNTANTS

U. S. A., CANADA, MEXICO, SOUTH AMERICA  
GREAT BRITAIN, CONTINENTAL EUROPE  
MIDDLE EAST, SOUTH AFRICA, AUSTRALIA

430 SEVENTH AVENUE  
PITTSBURGH 15219

The Shareholders and Directors  
Harbison-Walker Refractories Company

We have examined the accompanying consolidated statement of financial position of Harbison-Walker Refractories Company and subsidiaries at December 31, 1965, the related consolidated statements of current and retained income and of source and use of funds for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the consolidated statements mentioned above present fairly the financial position of Harbison-Walker Refractories Company and subsidiaries at December 31, 1965, the results of their operations and the source and use of their funds for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

*Arthur Young & Company*

February 2, 1966

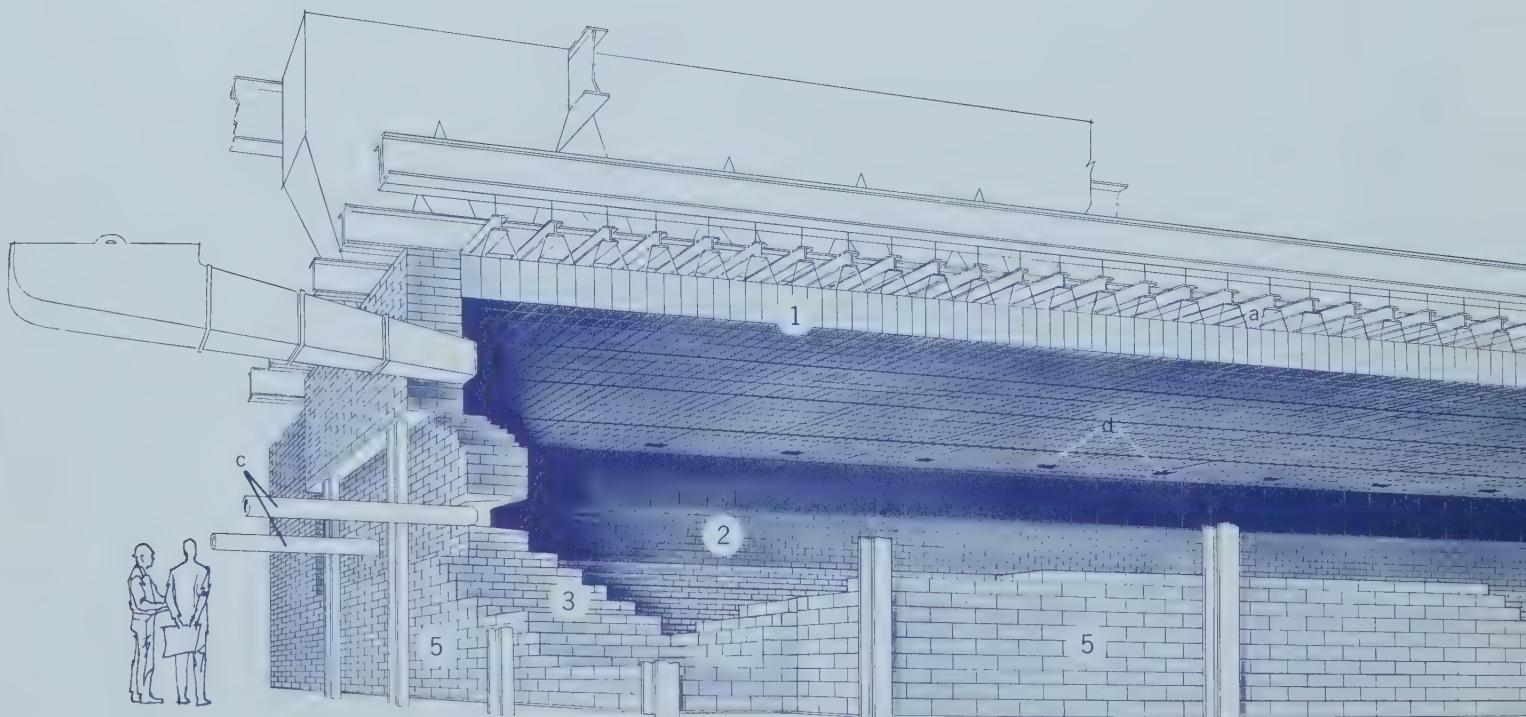
# HARBISON REFRactories IN THE COPPER REVERBERATORY SMELTING FURNACE AND THE COPPER CONVERTER

Harbison-Walker is a prominent supplier of refractories for the production of non-ferrous metals. By coordination of research, production and sales efforts, Harbison produces refractories that earn the reputation of leadership. In the exacting applications of the copper reverberatory smelting furnace and the copper converter, Harbison's prescription-type refractories extend the life of furnaces. At the same time more severe operating practices are possible for increased production.

The reverberatory smelting furnace and the converter fulfill important functions in copper processing which generally involves several processes. Copper-bearing ore typically contains  $\frac{1}{2}\%$  to 2% copper. The first process is the concentration of copper content to a 20% to 30% level by crushing, grinding, sizing, separating and frequently roasting to remove excess sulfur.

The concentrated ore undergoes the second process of smelting in the reverberatory furnace. The third process uses a converter to produce semi-refined (blister) copper of above 99% purity.

Copper is subsequently refined in various furnaces. Some are similar to but smaller than a smelting furnace. Purest copper is achieved by a process of electrolytic refining.



A typical reverberatory is illustrated below. It is a large, rectangular, refractory structure externally supported by steel framework. One of the very largest industrial furnaces, a copper reverberatory may be as long as 130 feet and as wide as 35 feet. The early furnace roofs were of silica refractories constructed in a highly rising arch. To permit higher temperatures, most reverberatory roofs are constructed of suspended basic refractories. A typical roof contains over 500 tons of basic shapes with the remainder of the furnace containing about 1,800 tons of shapes and bulk basic and silica refractories. A roof may be replaced in part every 1 to 3 years. Walls and flues may be replaced less frequently.

Concentrated copper ore is fed into the furnace through sidewall openings. It may also be fed from chutes extending above the long roof through apertures near the top of the sidewalls, as shown in the illustration. The ore is smelted at a temperature between 2200° and 2900° Fahrenheit. Heat is supplied from burners at one end of the furnace. Spent gases are exhausted through flues at the other end.

As the ore melts, its copper, iron and sulfur contents chemically react. The addition of silica allows the molten contents to separate into two layers. The top layer is slag which traps many impurities. The underlying layer is the matte which consists of compounds of copper, iron and sulfur. The two layers are tapped at different levels in the furnace sidewall. The slag is discarded. The matte is carried to the copper converter for further processing.

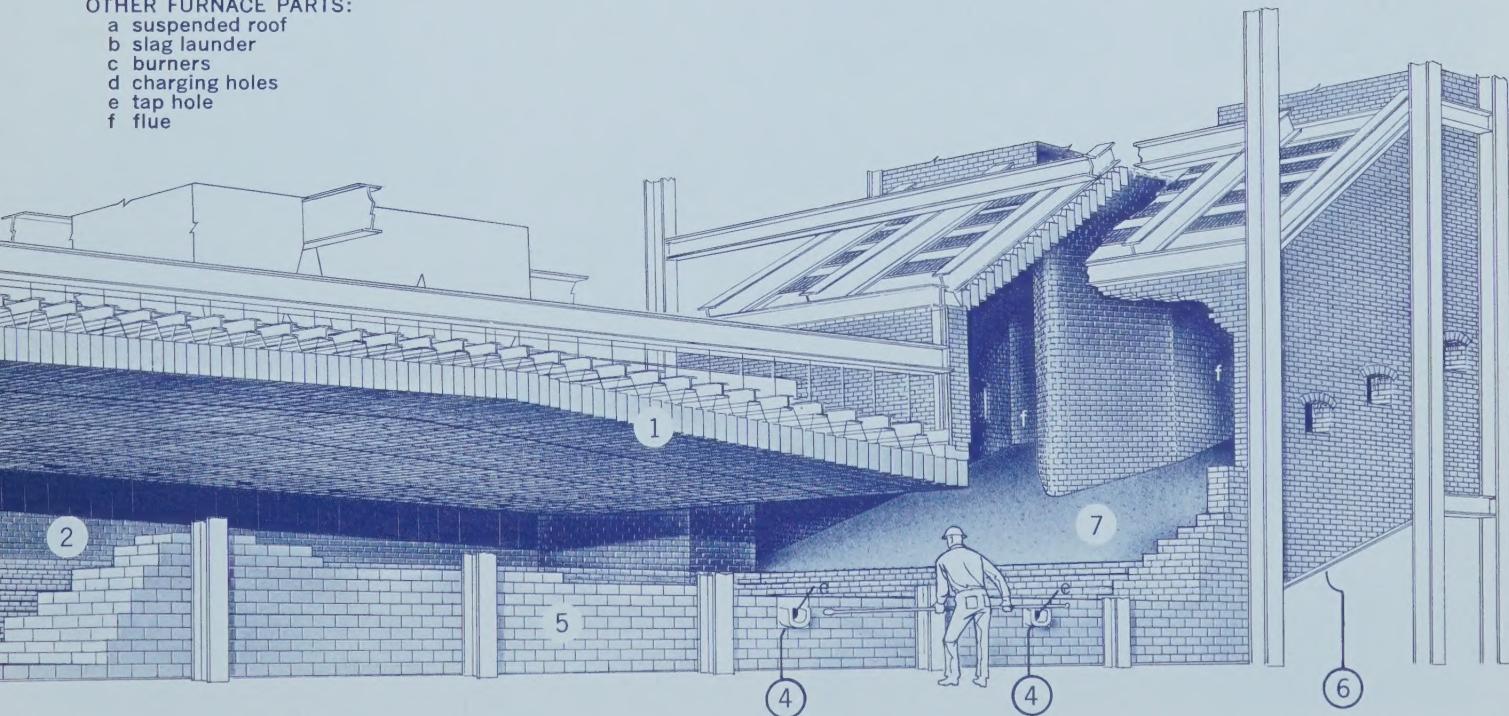
#### HARBISON-WALKER REFRactories:

##### Basic brick:

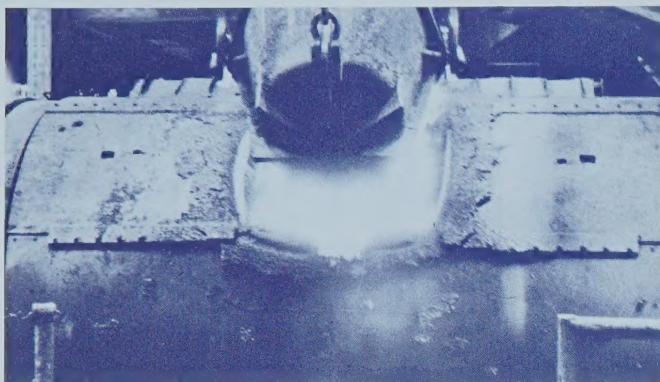
- 1 MAGNEX H or MAGNEX OHR
- 2 MAGNEX H
- 3 H-W MAGNESITE
- 4 GUIDON or
- 4 KORUNDAL XD high-alumina brick
- 5 ALAMO superduty fireclay brick
- 6 H-W 23 LI insulating brick
- 7 MAGNAMIX basic ramming mix

##### OTHER FURNACE PARTS:

- a suspended roof
- b slag launder
- c burners
- d charging holes
- e tap hole
- f flue



The copper converter is a barrel-shaped refractory vessel, typically 30 feet long and about 13 feet in diameter. The walls and ends are about 18 inches thick. They are constructed of about 150 tons of basic refractories. The complete lining typically is replaced after production of 18,000 to 25,000 tons of blister copper.



The converter is charged periodically with the molten matte and slag-forming flux, as pictured above. Forced air is then introduced from about 50 refractory-enclosed steel pipes called tuyeres arranged lengthwise in the converter. During the "blow" shown below, sulfur is oxidized which generates sufficient heat to convert the matte into blister copper. During the process, im-



purities rise to the top of the bath and become part of the slag which is periodically tapped by rotating the converter. More matte and slag-forming flux are then added. Eventually the blister copper is poured from the converter and taken to a refining furnace. The picture below shows copper of high purity being poured from a refining furnace into billets.



Harbison, through research and application studies, has developed refractories which are exceptionally resistant to corrosion and penetration by slag, impurities and the molten copper. The Company's basic refractories have increased the life of copper reverberatory furnaces. Production records have been set by copper converters constructed of specifically developed H-W COPUR brands. The Company's new direct-bonded GUIDON refractory of fused-grain magnesite-chrome shows unprecedented resistance in particularly troublesome areas, such as the reverberatory's taphole blocks and around the converter's tuyeres.

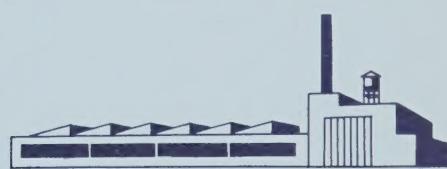
Domestic production of blister copper was relatively constant at about 1.6 million tons annually. It increased in 1965 to over 1.8 million tons. Growth is foreseen in 1966 to about 2.0 million tons and by 1970 to 2.4 million tons, up 50% from 1964. Producers are now operating at capacity. More output can be accomplished only by adding new capacity and by maximizing production from existing capacity through more severe operating practices. Both existing and new capacity will benefit from use of Harbison high performance, prescription refractories.

# Uses for REFRACTORIES



## IRON & STEEL

Air furnaces  
Annealing furnaces  
Basic oxygen furnaces  
Coke ovens  
Continuous casting  
Cupolas  
Electric furnaces  
Ferro alloy furnaces  
Forge furnaces  
Galvanizing and tin plating furnaces  
Induction furnaces  
Iron blast furnaces and stoves  
Iron ore beneficiation  
Ladles  
Malleable iron furnaces  
Metal mixers  
Open-hearth furnaces  
Pouring pits  
Reheating furnaces  
Soaking pits  
Vacuum degassing



## CHEMICALS & PETROLEUM

Acid and chemical constructions  
Butadiene reactors  
Catalyst beds  
Digesters  
Oil refining and processing furnaces  
Paper industry smelters  
Petrochemical equipment  
Petroleum coke calciners  
Phosphorus and phosphate furnaces  
Silicate of soda furnaces  
Sulfur burners

## POWER & FUELS

Carbon black furnaces  
Domestic heating furnaces  
Gas producers  
Gas reformers  
Incinerators  
Industrial stacks  
Industrial heating furnaces  
Marine boilers  
Missile launching pads  
Steam power furnaces

## CEMENT, GLASS & CERAMICS

Cement kilns  
Ceramic kilns  
Dolomite-lime kilns  
Enameling furnaces  
Frit furnaces  
Glass-tank furnaces  
Magnesite kilns

